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U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NO.
PLETZER ET AL-1 (PCT)TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)

10/049925

INTERNATIONAL APPLICATION NO.
PCT/EP00/06660INTERNATIONAL FILING DATE
JULY 13, 2000PRIORITY DATE CLAIMED
AUGUST 21, 1999TITLE OF INVENTION
METHOD AND CONSTRUCTION MACHINE FOR PRODUCING GROUND SURFACES

APPLICANT(S) FOR DO/EO/US

GEORG PLETZER ET AL.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. This is an express request to begin national examination procedures (35 U.S.C. 371 (f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l).
4. A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. is transmitted herewith (required only if not transmitted by the International Bureau)
 - b. has been transmitted by the International Bureau.
 - c. is not required, as the application was filed in the United States Receiving Office (RO/US).
6. A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
 - a. are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. have been transmitted by the International Bureau.
 - c. have not been made; however, the time limit for making such amendments has **NOT** expired.
 - d. have not been made and will not be made.

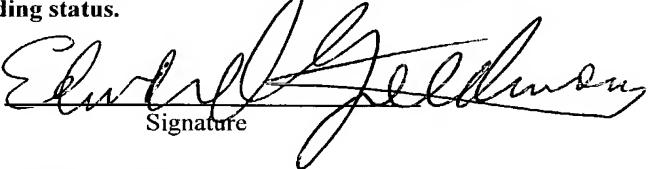
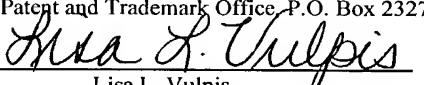
A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. A **FIRST** preliminary amendment.
 A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. A substitute specification.
15. A change of power of attorney and/or address letter.
16. Other items or information:

PCT/ISA/210 - Int'l. Search Report
4 Sheets of Formal Drawings

Applicant Claims Priority under 35 U.S.C. §119 of Germany Application No. 199 39 796.1 filed August 21, 1999.
Applicant Claims Priority under 35 U.S.C. §120 of: PCT No. PCT/EP00/06660 filed July 13, 2000.

APPLICATION NO. (if known, see 37 CFR 1.5)		INTERNATIONAL APPLICATION NO. PCT/EP00/06660	ATTORNEY'S DOCKET NO. PLETZER ET AL-1 (PCT)
10/049925		CALCULATIONS	PTO USE ONLY
<input checked="" type="checkbox"/> The following fees are submitted:			
Basic National Fee (37 CFR 1.492(a)(1)-(5)):			
Search Report has been prepared by the EPO or JPO.....\$890.00			
International preliminary examination fee paid to USPTO (37 CFR 1.482)\$710.00			
Neither international preliminary examination fee paid (37 CFR 1.82) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....\$1,040.00			
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4).\$100		\$ 890.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =			
SurchARGE of \$130.00 for furnishing the oath or declaration later than 20 30 months from the earliest claimed priority date (37 CFR 1.492(e)).			
Claims	Number Filed	Number Extra	Rate
Total Claims	12 - 20 =	- 0 -	X \$18.00
Independent Claims	2 - 3 =	- 0 -	X \$84.00
Multiple dependent claim(s) (if applicable)		+ \$280.00	\$
TOTAL OF ABOVE CALCULATIONS =		\$ 890.00	
Reduction by 1/2 for Small Entity status.		\$	
SUBTOTAL =		\$ 890.00	
Processing fee of \$130.00 for furnishing the English translation later than 20 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +		\$	
TOTAL NATIONAL FEE =		\$ 890.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +		\$	
TOTAL FEES ENCLOSED =		\$ 890.00	
		Amount to be: refunded	\$
		charged	\$
<input type="checkbox"/> Applicant claims Small Entity status.			
a. <input checked="" type="checkbox"/> A check in the amount of \$890.00 to cover the above fees is enclosed.			
b. <input type="checkbox"/> Please charge my Deposit Account No. 03-2468 in the amount of \$ to cover the above fees. A duplicate copy of this sheet is enclosed.			
c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment, to Deposit Account No. 03-2468. A duplicate copy of this sheet is enclosed.			
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.			
SEND ALL CORRESPONDENCE TO: COLLARD & ROE, P.C. 1077 Northern Boulevard Roslyn, New York 11576-1696 (516) 365-9802		 Signature Edward R. Freedman Reg. No. 26,048	
Express Mail No. EL 871 452 155 US			
Date of Deposit February 20, 2002			
I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10, on the date indicated above, and is addressed to the BOX PCT, U.S. Patent and Trademark Office, P.O. Box 2327, Arlington, VA 22202.			
 Lisa L. Vulpis			

10/049925
JC10 Rec'd PCT/PTO 2.0 FEB 2002

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: GEORG PLETZER ET AL-1 (PCT)

PCT No.: PCT/EP00/06660 FILED: JULY 13, 2000

TITLE: METHOD AND CONSTRUCTION MACHINE FOR PRODUCING GROUND SURFACES

PRELIMINARY AMENDMENT

BOX PCT

U.S. Patent and Trademark Office
P.O. Box 2327
Arlington, VA 22202

Dear Sir:

Preliminary to Examination, please amend the above-identified application as follows:

IN THE SPECIFICATION

Page 1, after the title, please insert as follows:

--CROSS REFERENCE TO RELATED APPLICATIONS

Applicants claim priority under 35 U.S.C. §119 of German Application No. 199 39 796.1 filed August 21, 1999. Applicants also claim priority under 35 U.S.C. §120 of PCT/EP00/06660 filed July 13, 2000. The international application under PCT article 21(2) was not published in English.--

IN THE CLAIMS

Please amend claims 4, 5, 11, and 12 as follows:

4. (Amended) The method according to claim 1, characterized in that the position of the point of gravity of the excavator equipment is monitored and the compensation pressure is automatically adapted to any shift in the position of the point of gravity.

5. (Amended) The method according to claim 1, characterized in that the admission of the compensation pressure is terminated upon actuation of the control device by the operator.

11. (Amended) The construction machine according to claim 6, characterized in that provision is made for a selector switch (14) for adjusting the compensation pressure.

12. (Amended) The construction machine according to claim 6, characterized in that provision is made in a control line (31) leading to the pressure control valve (13) or to the pressure-regulated servo-pump (27) for a measuring instrument for detecting any shift in the position of the point of gravity of the excavator equipment, said measuring instrument supplying a modulated control signal to the pressure control valve (13) or to the pressure-regulated servo-pump (27) in order to change the compensation pressure in such a way that the force of application

of the shovel (7) remains constant as the latter is moving and working.

A marked-up version is shown as Exhibit A.

REMARKS

By this Preliminary Amendment, a cross-reference to related applications has been inserted in page 1. Amended claims 4, 5, 11, and 12 to remove the multiple dependency of these claims. No new matter has been introduced. Entry of this amendment is respectfully requested.

Respectfully submitted,
GEORG PLETZER ET AL.

By: 
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Edward R. Freedman, Reg. No. 26,048
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ERF/llv

Enclosure: Exhibit A

EXPRESS MAIL NO. EL 871 452 155 US

Date of Deposit: February 20, 2002

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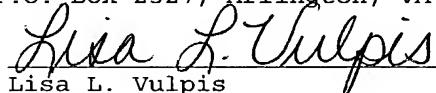

Lisa L. Vulpis

EXHIBIT A

VERSION WITH MARKINGS TO SHOW CHANGES MADE TO
CLAIMS 4, 5, 11, AND 12

4. (Amended) The method according to claim 1, [2 or 3,] characterized in that the position of the point of gravity of the excavator equipment is monitored and the compensation pressure is automatically adapted to any shift in the position of the point of gravity.

5. (Amended) The method according to claim 1, [2, 3 or 4,] characterized in that the admission of the compensation pressure is terminated upon actuation of the control device by the operator.

11. (Amended) The construction machine according to claim 6 [or any one of the subsequent claims], characterized in that provision is made for a selector switch (14) for adjusting the compensation pressure.

12. (Amended) The construction machine according to claim 6 [or any one of the subsequent claims], characterized in that provision is made in a control line (31) leading to the pressure control valve (13) or to the pressure-regulated servo-pump (27) for a measuring instrument for detecting any shift in the position of the point of gravity of the excavator equipment, said measuring instrument supplying a modulated control signal to the pressure control valve (13) or to the pressure-regulated servo-pump (27) in order to change the compensation pressure in such a way that the force of application of the shovel (7) remains constant as the latter is moving and working.

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JC10 Rec'd PCT/PTO 20 FEB 2002

METHOD AND CONSTRUCTION MACHINE FOR PRODUCING GROUND
SURFACES

The invention relates to a method for producing ground surfaces by means of a construction machine, in particular to a hydraulic excavator, comprising excavator equipment comprised of more or more components, including a shovel that can be placed on the ground surface, and a lifting cylinder for lifting and lowering the excavator equipment; whereby the lifting cylinder of the excavator equipment is actively connected with at least one work pump that can be actuated by the excavator operator via a control device; and whereby the lifting cylinder is lifted, lowered or blocked depending on the position to which the control device is set.

Furthermore, the invention relates to a construction machine, in particular to a hydraulic excavator for constructing ground surfaces, comprising excavator equipment consisting of one component or a multitude of components, including a shovel that can be placed on the ground surface, and a lifting cylinder for lifting and lowering the excavator equipment; whereby the lifting cylinder of the excavator equipment is actively connected with at least one work pump via a control device that can be actuated by the excavator operator; and whereby the lifting cylinder can be

lifted, lowered or blocked depending on the position to which the control device is switched.

Hydraulic excavators are frequently employed for the construction of level ground surfaces. It is necessary for said purpose to guide the shovel or cutting edge of the shovel across the ground surface being constructed with no or only minor force of application to surface of the ground because varying forces of application may lead to corrugations on the surface of the ground.

Due to the fact that simultaneous movements of three cylinders (lifting cylinder; stem cylinder; shovel cylinder) are required in connection with hydraulic excavators for the purpose of guiding the shovel across a level ground surface with controlled force of application to the ground, extraordinary skill is required on the part of the operator to carry out this operation with good results. If, for example, the stem of the excavator equipment is moved, the entire jib has to be lifted or lowered at the same time in order to keep the cutting edge of the shovel on the level surface of the ground. When the stem and the shovel are moved simultaneously, correction of the jib becomes even more complex.

Therefore, various types of construction have become known which are expected to support the operator of

hydraulic excavators in the production of level ground surfaces. In addition to mechanical guides by means of parallelogram kinematics or by means of electronic track movement of the shovel, other simpler support systems have become known.

Designs are known in connection with which the lifting cylinders are switched to a so-called floating position. Both sides of the lifting cylinder are connected in this case with the tank. The inherent weight of the excavator equipment rests on the shovel, and the jib is then lifted and lowered depending on the condition of the underground. The drawback is that the weight of the entire excavator equipment is fully resting on the shovel, causing the latter to have the tendency to penetrate the ground to a deeper extent. It is not possible in this way to produce a clean, level ground surface.

Another system is shown in US 5,855,159, in which provision is made in the lowering line of the lifting cylinder for a pressure control valve that can be switched from normal operating pressure to a selectable low pressure value. The switch is carried out by the control pressure of an auxiliary pump acting on the adjustment of the pressure control valve. The effect of the system is that the shovel is capable of yielding in the lifting direction due to digging forces because the hydraulic oil drains from the

cylinder space on the side of the piston rod under lower pressure via the pressure control valve. Since no further hydraulic oil is supplied to the lifting side of the cylinder, the weight of the excavator equipment is resting on the shovel.

Said system thus does provide any support for the operator for constructing level ground surfaces because the force for lifting the excavator equipment is composed of the weight of the latter plus the remaining cylinder force on the side of the piston rod. Said forces cause the shovel to penetrate the ground.

Therefore, the problem of the invention is to provide a solution by which ground surfaces can be produced as level as possible in a simpler and faster manner with the help of construction machines, in particular with hydraulic excavators.

Said problem is solved according to the invention in connection with a method of the type specified above in that for compensating the weight of the excavator equipment and for adjusting an approximately constant force of application with which the shovel rests on the ground surface as the excavator equipment is moving, working the ground, the lifting side of the lifting cylinder is automatically acted upon after an actuating element has been triggered, by

feeding or evacuating a hydraulic medium with adjustable compensation pressure.

According to the invention, the force of application with which the shovel rests on the ground is thus reduced and is notably kept very low and as constant as possible, whereby such force of contact with the ground is automatically controlled for relieving the work of the operator. For said purpose, the piston side of the lifting cylinder is supplied with a suitable hydraulic medium, for example pressure oil, which compensates the weight of the excavator equipment to a great extent and in that way reduces the force of application of the shovel to the ground surface to a low value, or eliminates such force entirely. Said method relieves the operator considerably because the jib needs not to be controlled in the course of the leveling operation. Owing to such relief and the automatic control it is possible to guide the shovel across the ground surface substantially more rapidly, which increases the economy. Another advantage is that the risk of causing damage to cables and pipelines is reduced.

The compensation pressure for compensating the weight can be supplied in different ways. For example, the compensation pressure can be generated by an additional pump or by the work pump itself.

Furthermore, the method can be improved further by monitoring the position of the point of gravity of the excavator equipment and automatically adapting the compensation pressure if the point of gravity shifts.

In order to make it possible for the operator to intervene manually, if need be, provision is made, furthermore, that the application of compensation pressure is shut off when the control device is actuated by the operator.

For solving the problem specified above, the invention, furthermore, makes provision for a construction machine, in particular for a hydraulic excavator that is characterized in that for compensating the weight of the excavator equipment, and for adjusting an approximately constant force with which the shovel rests on the ground surface as the excavator equipment is being operated, the lifting side of the lifting cylinder is connected via a switchable actuating element with a system for feeding or evacuating hydraulic medium for supplying a compensation pressure that can be adjusted to a constant value.

In connection with a first embodiment of the construction machine, provision is made that the system for feeding and evacuating hydraulic medium is comprised of a valve, which is realized in the form of a control slide installed in

parallel with the control device; an auxiliary pump; and a tank, whereby the valve supplies the compensation pressure generated by the auxiliary pump to the lifting side of the lifting cylinder and connects the lowering side of the lifting cylinder with the tank, whereby the pressure of the auxiliary pump can be adjusted.

If the valve, for example a 4/2-way valve, is switched by the operator via the actuating element to the operating position "leveling", which can be set either for continuous leveling via a switch or for leveling for a short time via a key, the 4/2-way valve feeds the pressure of the auxiliary pump into the lifting conduit of the lifting cylinder between the control slide and the lifting cylinder. The lowering conduit is connected with the tank by the 4/2-way valve. The control slide remains closed during this operation.

So as to be able to adjust the compensation pressure, provision is advantageously made that the pressure of the auxiliary pump can be adjusted via a pressure control valve. Said pressure control valve can be adjusted to difference pressure values via a selector switch. Via the selector switch, the operator sets a pressure of such a value that almost completely compensates the weight of the excavator equipment. The leveling work is carried out with the control slide in the zero position; the lifting cylinder of the jib

needs not to be controlled during leveling; and the auxiliary pump and the pressure control valve assure that the excavator equipment is always supported on the ground surface via the shovel with the force selected for its application to the surface of the ground. The point of gravity of the excavator equipment does in fact shift due to the movement of stem and the shovel, so that changes may occur in the force with which the shovel is in contact with the ground. Such changes, however, are minor.

Instead of using an auxiliary pump with a pressure control valve, it is possible also to make provision for an alternative by providing the auxiliary pump in the form of an adjustable, pressure-controlled servo-pump in order to replace the pressure control valve and to avoid energy losses.

For serving energy, it is possible to switch the pressure control valve or pressure-regulated servo-pump to pressureless operation or zero delivery when the switches are turned off.

In a second embodiment of the construction machine, provision is made that the device serving for supplying and evacuating the hydraulic medium is formed by the work pump, and that the control device designed in the form of a control slide and actuated by a manual control valve can be

separated from the valve by means of a valve and switched to the lifting position via the constant pressure of a control pump; and, furthermore, that a pressure control valve is installed in the conduit leading from the control slide to the lifting side of the lifting cylinder, in a manner such that the compensation pressure can be supplied by the work pump. When the leveling operation is switched on by the excavator operator, the control slide is continuously switched to lifting via a valve. A simultaneously activated pressure control valve, which is installed in the lifting conduit between the control slide and the lifting side of the lifting cylinder, controls the pressure in such a way that the weight of the excavator equipment is almost fully compensated. The lowering side of the lifting cylinder is connected then with the tank via the control slide. At the same time, the work pump is switched to a predetermined reduced amount of delivery by a pressure reduction valve installed in the control line leading to the work pump.

Provision is made for a selector switch that can be actuated by the operator, so that the compensation pressure can be set by the operator in a simple manner.

Any shift in the point of gravity occurring in the course of the leveling operation due to the movement of the stem changes the force with which the shovel is applied to the ground. So that said force can be exactly maintained at a

constant level, provision is made for a measuring instrument for detecting the shift in the point of gravity of the excavator equipment, for example for a potentiometer detecting the angular position of the stem, which is provided in a control line leading to the pressure control valve or pressure-regulated servo-pump. Such a measuring instrument supplies the pressure control valve or pressure-regulated servo-pump with a modulated control signal in order to change the compensation pressure in such a way that the force of application of the shovel to the surface of the ground is kept constant as the latter is working the surface.

The invention is explained in greater detail in the following by way of example with the help of the drawing. In the drawing,

FIG. 1 shows a first embodiment of a construction as defined by the invention, with an auxiliary pump and pressure control valve.

FIG. 2 shows a second embodiment with a pressure-regulated servo-pump.

FIG. 3 shows the embodiment according to FIG. 2 with an additional measuring system for supplying a constant force of application of the shovel; and

FIG. 4 shows another embodiment of the construction machine without the auxiliary pump, in which the work pump supplies the weight compensation.

FIG. 1 shows a construction machine, specifically a hydraulic excavator, which is generally denoted by 1. Said hydraulic excavator 1 is equipped with excavator equipment comprised of a jib 2, a lifting cylinder 3, a stem cylinder 4, a stem 5, a shovel cylinder 6, and a shovel 7.

The lifting cylinder 3 is connected to a control device in the form of a control slide 8 via the lines 10, 11, whereby the control slide is blocking the lifting cylinder 3 when it is set in position 0; lifting the excavator equipment when it is set in position 1; and lowering the excavator equipment when it is set in position 2.

For supplying the control slide 8 with a hydraulic medium, provision is made for a work pump 5, which is usually employed for other operational functions of the hydraulic excavator 1 as well. The control slide 8 is actuated by the operator by means of a manual control valve 17 that is supplied by a control pump 37 via the lines 21, 22.

A 4/2-way valve 12 is arranged parallel with the control slide 8. When in the idle position (0), said 4/2-way valve is blocking the lines 23, 24 and connecting an auxiliary pump 29 with the tank. When set to the switching position P, the valve 12 is connecting the auxiliary pump 29 with the lifting side of the lifting cylinder 3 via the line 23 and the line 11, whereas the lowering side of the lifting cylinder 3 is connected with the tank via the line 10 and the line 24. The valve 12 is switched on by a voltage source 26 via a switch 18 or a key 16. The pressure of the auxiliary pump 29 can be adjusted via a pressure control valve 13, which can be controlled in preset ranges by means of a selector switch 14.

Downstream of the switches 16, 18, which are connected in parallel, provision is made for a switch 15, which breaks the power supply as soon as the manual control valve 17 is actuated. Said manual control valve actuates the switch 15 via a reversing valve 36 and via a line 25. The weight compensation explained in greater detail below is switched off in this way and the pressure control valve 13 is set to pressureless passage.

The embodiment according to FIG. 2 is different from the one according to FIG. 1 in that provision is made for a pressure-regulated servo-pump 27 replacing the pressure control valve 13 and the auxiliary pump 29. The pressure of

the pressure-regulated servo-pump 27 is controlled via a line 31 by means of the selector switch 14, and the pump 27 is switched to zero delivery as soon as the switch 15 breaks the power supply.

FIG. 3 shows the hydraulic excavator 1 according to FIG. 2 with an additional measuring instrument 32, which is installed in a control line 31. The measuring instrument 32 is, for example a potentiometer and measures the angular position between the stem 5 and the jib 2. Depending on the position of the stem 5, the signal for the pressure control valve 13 or the pressure-regulated servo-pump 27 is modulated by the measuring device 32 via a line 33 in such a way that the force of application of the shovel 7 to the ground surface can be maintained at a constant level.

FIG. 4 shows another embodiment of a hydraulic excavator as defined by the invention, whereby the same reference numerals are used as in the preceding figures to the extent such numerals denote identical components.

As opposed to the embodiments described above, provision is made in the hydraulic excavator 1 according to FIG. 4 for the work pump 9 serving as the pressure source for the compensation of the weight. The pressure control valve 13 is therefore connected to the line 11 leading to the lifting side of the lifting cylinder 3. When the switch 16 or 18 is

actuated, a 3/2-way valve 36 shuts off the manual control valve 17 and connects the constant pressure of the control pump 37 to the switching side of the control slide via a line 38, which causes said switching side to switch on the lifting operation of the lifting cylinder 3 of the jib 2.

Furthermore, the signal of the switches 16, 18 effects the activation of the pressure control valve 13 via a selector switch 14, as well as the reduction of the delivery of the pump 9 by means of a pressure reduction valve 35, which modulates the signal of the pump control 34 in such a way that a preset volume of delivery of the work pump is made available. When the manual control valve 17 is actuated, the weight compensation is shut off by the switch 15 via a reversing valve 36 and the line 25, and the control of the control slide 8 by means of the manual control valve 17 is re-established.

The mode of operation of the hydraulic excavators 1 described above for producing an approximately level ground surface is described as follows:

If the hydraulic excavator 1 is to be employed for leveling work or similar work operations, the operator switches the switch 18, or for short work operations actuates the key 16 and thus the valve 12 to position (P), or the valve 36. At the same time, the operator pre-selects

the force of application of the shovel 7 by means of the selector switch 14. The lifting side of the lifting cylinder 3 is now connected with the activated pressure control valve 13 or the pressure-regulated servo-pump 27 and supports the jib 2 to the selected extent. For leveling work, the operator then moves only the stem and the shovel 7; the jib 2 is automatically adjusted in such a way that the weight compensation system maintains the selected value.

If the weight compensation is selected in such a way that the shovel 7 rests on the plane surface of the ground with only very low force, the method of the invention results in the following operational sequences:

If the shovel 7 is driven over a ground surface in such a way that the jib 2 has to be lifted in order to follow the contour of the surface, such a movement increases the force of application of the shovel 7 to the ground. Any slight increase in the application force effects an immediate automatic lifting of the jib 2 by a measure such that the shovel 7 will continue to rest on the surface of the ground with the selected low force of application. Owing to the fact that the auxiliary pump 29 or work pump 9 is permanently connected with the lifting surface of the lifting cylinder 3, the pressure oil required for lifting the jib 2 is always available. If the shovel 7 is moved over the surface of the ground in such a way that the jib 2 has

to be lowered, the latter is lowered automatically as soon as the shovel loses contact with the ground, and the adjusted force of application supplies the force required for lowering the jib. The hydraulic oil then drains from the lifting side of the lifting cylinder 3 via the pressure control valve 13, whereas the lowering side is connected with the tank and capable of sucking in more hydraulic oil.

In this way, the shovel 7 is automatically following the contour of the surface of the ground with nearly constant force of application to the ground.

It is not necessary in the course of the operations described above to actuate the actual control slide 8 of the lifting cylinder 3; said control slide can remain in the blocking position. If the control slide 8 is additionally switched on by the operator with the manual control valve 17 via the line 22 as the weight compensation is switched on and operating, the weight compensation is interrupted and the jib 2 can be controlled by the operator.

Claims

1. A method for producing ground surfaces by means of a construction machine, in particular a hydraulic excavator with an excavator comprised of one single or a multitude of components including a shovel applicable to the surface of the ground, and a lifting cylinder for lifting and lowering the excavator equipment; whereby the lifting cylinder of the excavator equipment is actively connected with a least one work pump via a control device actuated by the operator; and whereby the lifting cylinder is lifted, lowered or blocked depending on the switching position of the control device; characterized in that for compensating the weight of the excavator equipment and for adjusting an approximately constant pressure of application of the shovel to the surface of the ground as the excavator equipment is moving and working, the lifting side of the lifting cylinder, upon actuation of an actuating element, is automatically acted upon by an adjustable compensation pressure by supplying or evacuating a hydraulic medium.

2. The method according to claim 1, characterized in that the compensation pressure is generated by an additional pump.

3. The method according to claim 1, characterized in that the compensation pressure is generated by the work pump.

4. The method according to claim 1, 2 or 3,
characterized in that the position of the point of gravity
of the excavator equipment is monitored and the compensation
pressure is automatically adapted to any shift in the
position of the point of gravity.

5. The method according to claim 1, 2, 3 or 4,
characterized in that the admission of the compensation
pressure is terminated upon actuation of the control device
by the operator.

6. A construction machine, in particular a hydraulic
excavator for producing ground surface with excavator
equipment comprising one or more components, including a
shovel (7) applicable to the ground surface, and a lifting
cylinder (3) for lifting and lowering the excavator
equipment, whereby the lifting cylinder (3) of the excavator
equipment is actively connected with at least one work pump
(9) via a control device (8) actuated by the operator, and
whereby the lifting cylinder (3) can be lifted, lowered or
blocked depending on the switching position of the control
device (8); characterized in that for compensating the
weight of the excavator equipment and for adjusting an
approximately constant force of application of the shovel
(7) to the surface of the ground, the lifting side of the
lifting cylinder (3) is connected via a switchable actuating

element (16, 18) with a system for supplying and evacuating hydraulic medium for admitting a constant, adjustable compensation pressure.

7. The construction machine according to claim 6, characterized in that the system for supplying or evacuating hydraulic medium comprises a valve (12) arranged parallel with the control device designed in the form of a control slide (8); an auxiliary pump (29); and a tank; whereby the valve (12) delivers the compensation pressure generated by the auxiliary pump (29) to the lifting side of the lifting cylinder (3), and connects the lowering side of the lifting cylinder (3) with the tank; and whereby the pressure of the auxiliary pump (29) is adjustable.

8. The construction machine according to claim 7, characterized in that the pressure of the auxiliary pump (29) can be adjusted via a pressure control valve (13).

9. The construction machine according to claim 7, characterized in that the auxiliary pump is an adjustable, pressure-regulated servo-pump (27).

10. The construction machine according to claim 6, characterized in that the device for supplying and evacuating hydraulic medium is formed by the work pump (9) and the control device designed in the form of a control

slide (8) and actuated by a manual control valve (17) can be separated from the manual control valve (17) by means of a valve (36) and switched to the lifting position via the constant pressure of a control pump (37); and that a pressure control valve (13) is installed in the line (11) leading from the control slide (8) to the lifting side of the lifting cylinder (3), in a way such that the compensation pressure can be supplied by the work pump (9).

11. The construction machine according to claim 6 or any one of the subsequent claims, characterized in that provision is made for a selector switch (14) for adjusting the compensation pressure.

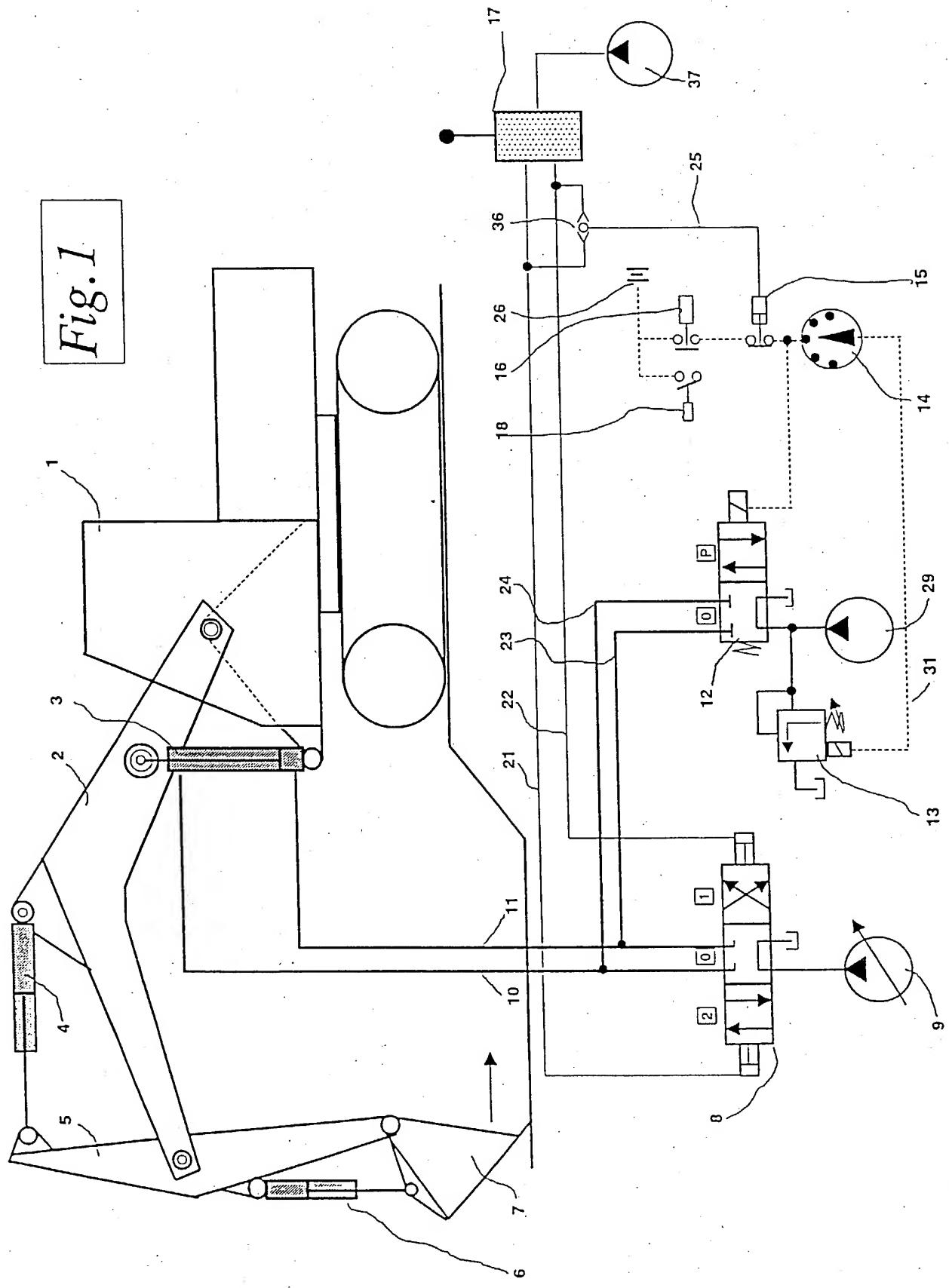
12. The construction machine according to claim 6 or any one of the subsequent claims, characterized in that provision is made in a control line (31) leading to the pressure control valve (13) or to the pressure-regulated servo-pump (27) for a measuring instrument for detecting any shift in the position of the point of gravity of the excavator equipment, said measuring instrument supplying a modulated control signal to the pressure control valve (13) or to the pressure-regulated servo-pump (27) in order to change the compensation pressure in such a way that the force of application of the shovel (7) remains constant as the latter is moving and working.

Abstract

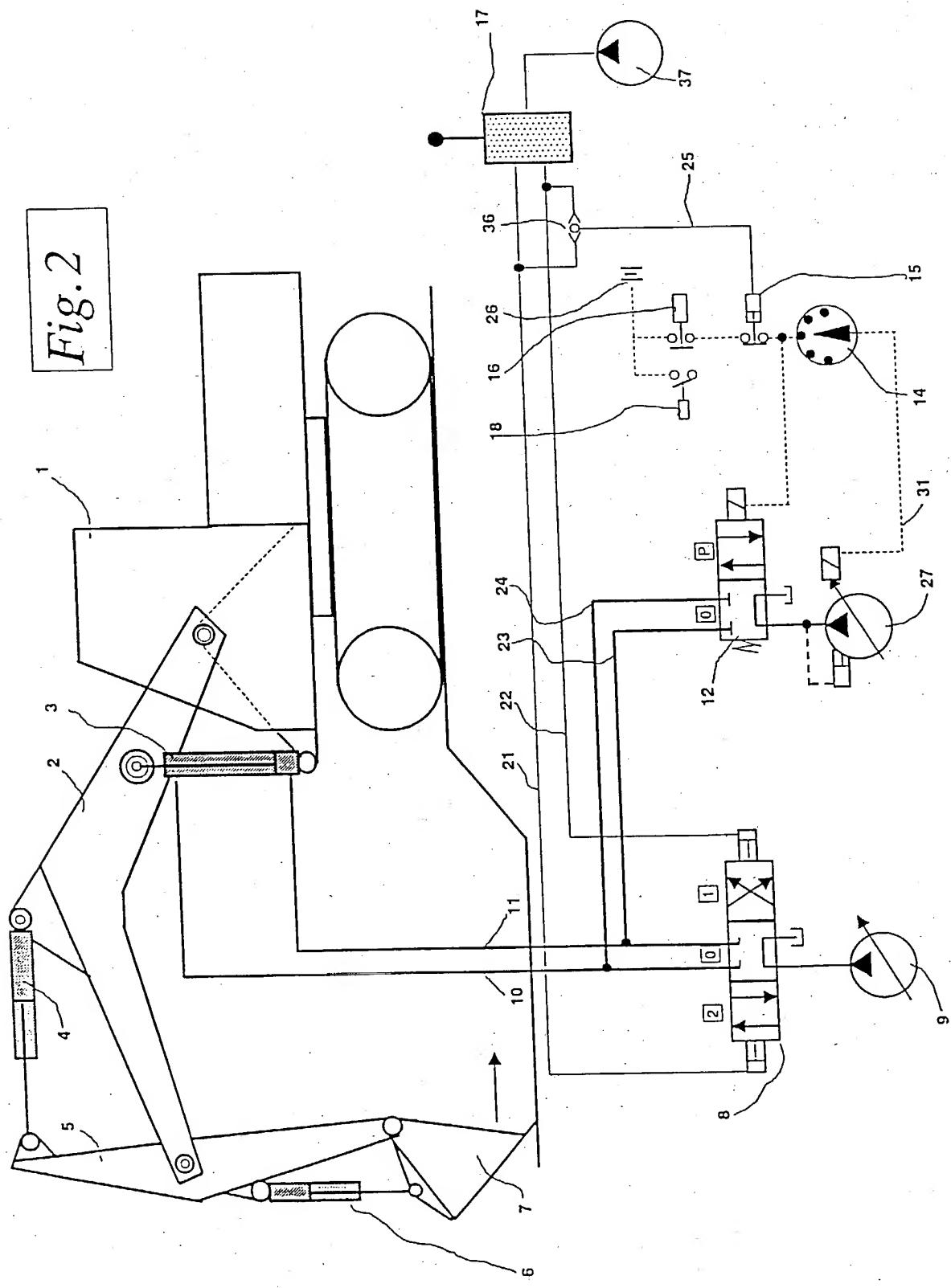
With a method for producing ground surfaces by means of a construction machine, in particular a hydraulic excavator comprising excavator equipment consisting of a single component or more components including a shovel applicable to the ground surface and a lifting cylinder for lifting and lowering the excavator equipment, whereby the lifting cylinder of the excavator equipment is actively connected with at least one work pump via a control device actuated by the operator, and whereby the lifting cylinder is lifted, lowered or blocked depending on the position to which the control device is switched, the aim is to provide a solution by which ground surfaces can be produced as level as possible in a simpler and faster way.

This is achieved in that for compensating the weight of the excavator equipment and for adjusting an approximately constant force of application of the shovel to the surface of the ground as the excavator equipment is moving and working, the lifting side of the lifting cylinder, following actuation of an actuating element, is automatically acted upon by an adjustable compensation pressure by supplying or evacuating a hydraulic medium.

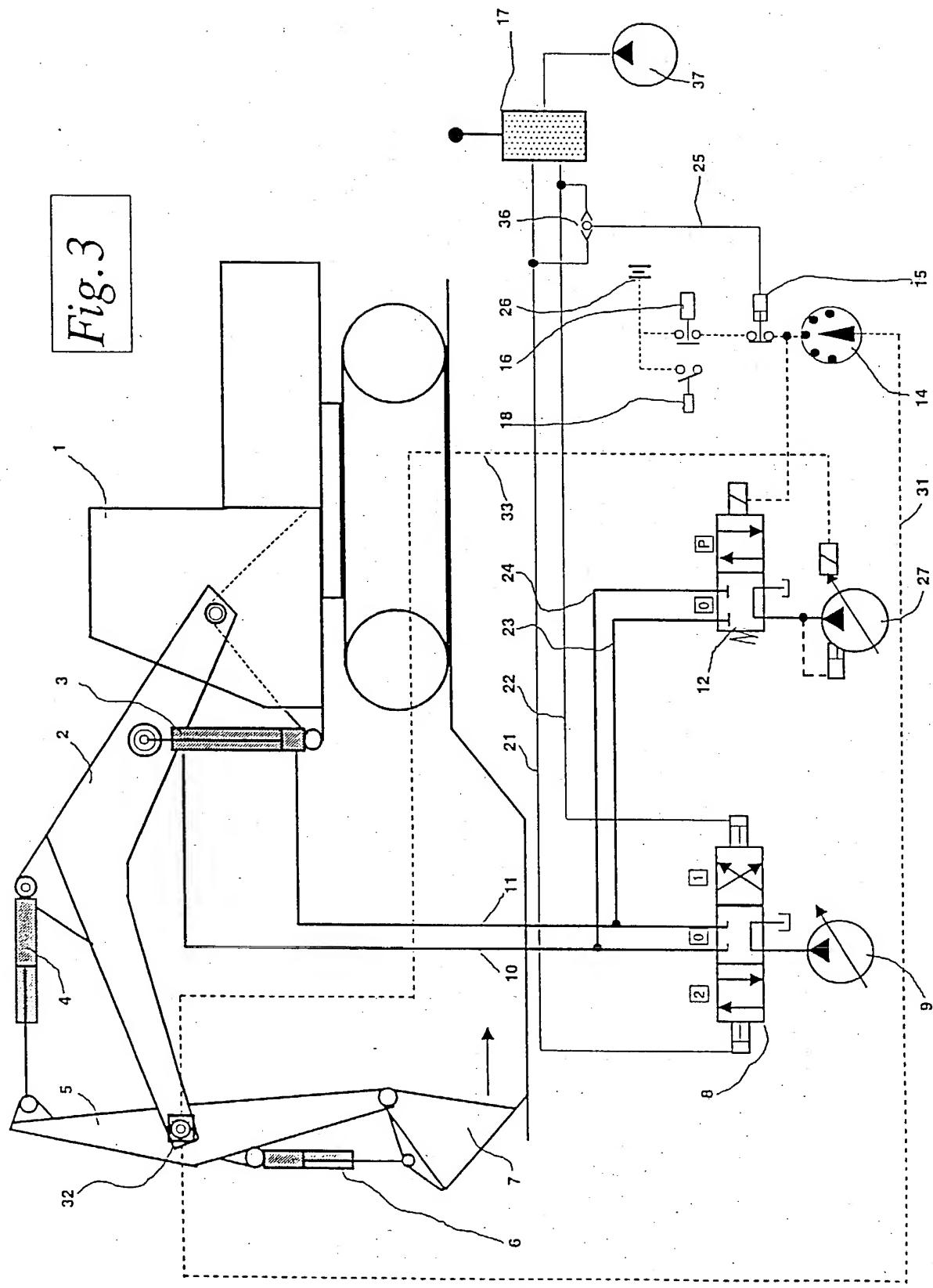
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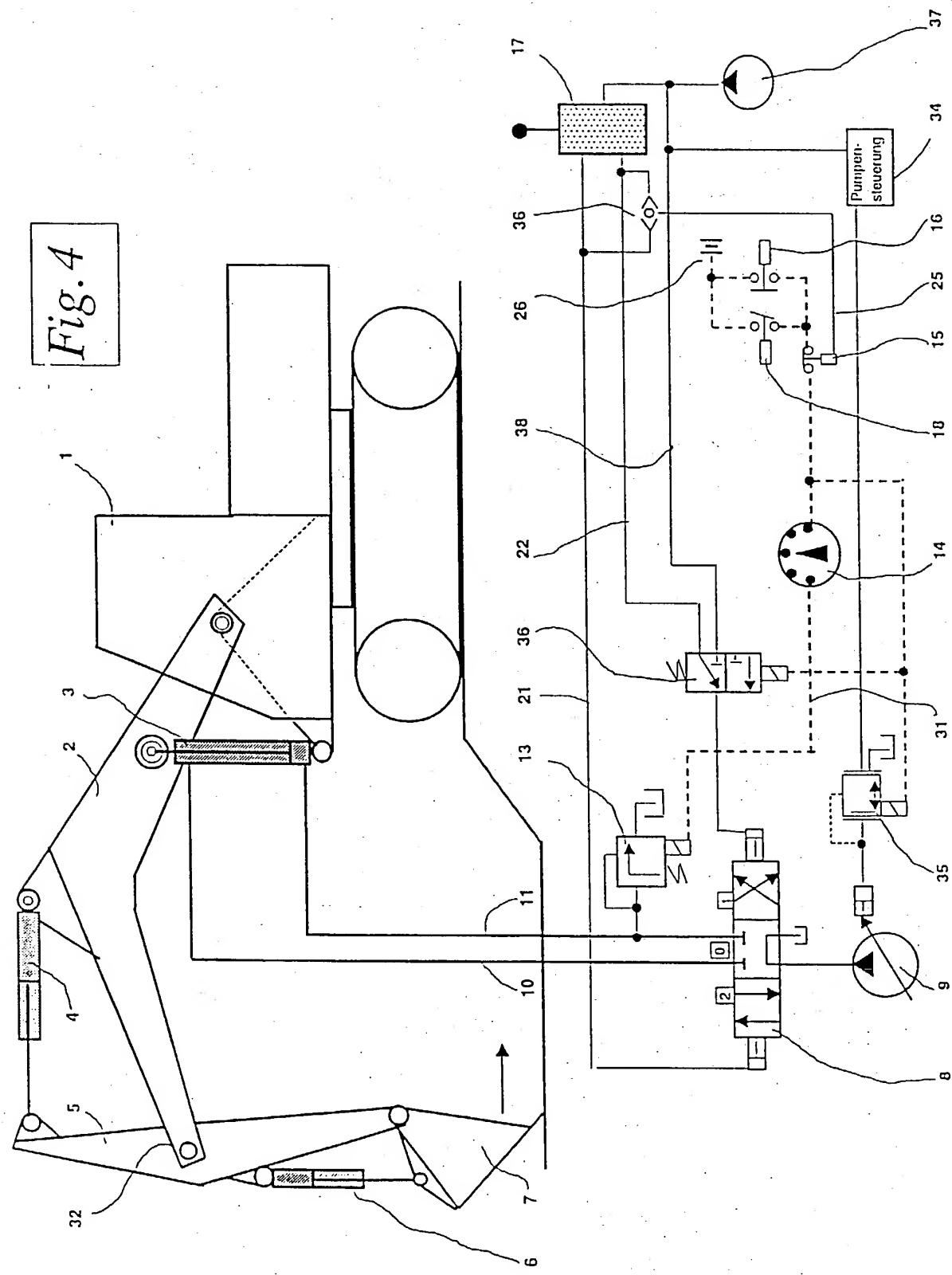
10/049925



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10/049925



COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY
(Includes Reference to PCT International Applications)

ATTORNEY'S DOCKET NUMBER
PLETZER ET AL-1 PCT

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD AND CONSTRUCTION MACHINE FOR PRODUCING GROUND SURFACES

the specification of which (check only one item below):

is attached hereto.

was filed as United States application

Serial No. _____

on _____,

and was amended

on _____ (if applicable).

was filed as PCT international application

Number PCT/EP00/06660

on 13 JULY 2000,

and was amended under PCT Article 19

on _____ (if applicable).

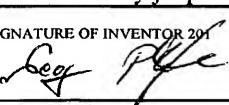
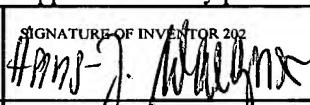
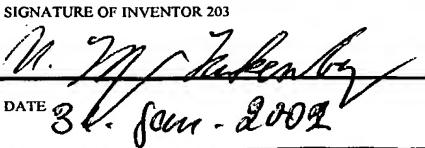
I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT, indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 U.S.C. 119
GERMANY	199 39 796.1	21 AUGUST 1999	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (Includes Reference to PCT International Applications)		ATTORNEY'S DOCKET NUMBER PLETZER ET AL-1 PCT	
I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:			
PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:			
U.S. APPLICATIONS		STATUS (Check One)	
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	
		PENDING	
		ABANDONED	
PCT APPLICATIONS DESIGNATING THE U.S.			
PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)	
POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration numbers):			
ALLISON C. COLLARD, Registration No. 22,532; EDWARD R. FREEDMAN, Registration No. 26,048; ELIZABETH COLLARD RICHTER, Registration No. 35,103		KURT KELMAN, Registration No. 18,628 FREDERICK J. DORCHAK, Registration No. 29,298 WILLIAM C. COLLARD, Registration No. 38,411 ROBERT W. GRIFFITH, Registration No. 48,956	
Send Correspondence to: COLLARD & ROE, P.C. 1077 Northern Boulevard Roslyn, New York 11576		Customer No. 25889	
		Direct Telephone Calls to: (name and telephone number) (516) 365-9802	
1-002	FAMILY NAME <u>PLETZER</u>	FIRST GIVEN NAME <u>GEORG</u>	SECOND GIVEN NAME
0	RESIDENCE & CITIZENSHIP <u>CITY BERLIN</u>	STATE OR FOREIGN COUNTRY <u>GERMANY</u>	COUNTRY OF CITIZENSHIP <u>GERMANY</u> <u>DEX</u>
1	POST OFFICE ADDRESS <u>POPITZWEG 5</u>	CITY <u>D-13627 BERLIN</u>	STATE & ZIP CODE/COUNTRY <u>GERMANY</u>
2-68	FAMILY NAME <u>WAEGNER</u>	FIRST GIVEN NAME <u>JOACHIM</u>	SECOND GIVEN NAME
0	RESIDENCE & CITIZENSHIP <u>CITY WALTROP</u>	STATE OR FOREIGN COUNTRY <u>GERMANY</u>	COUNTRY OF CITIZENSHIP <u>GERMANY</u> <u>DEX</u>
2	POST OFFICE ADDRESS <u>BAHNHOFSTRASSE 87</u>	CITY <u>D-45731 WALTROP</u>	STATE & ZIP CODE/COUNTRY <u>GERMANY</u>
3-68	FAMILY NAME <u>LACKENBERG</u>	FIRST GIVEN NAME <u>HEINRICH</u>	SECOND GIVEN NAME
0	RESIDENCE & CITIZENSHIP <u>CITY SELM</u>	STATE OR FOREIGN COUNTRY <u>GERMANY</u>	COUNTRY OF CITIZENSHIP <u>GERMANY</u> <u>DEX</u>
3	POST OFFICE ADDRESS <u>KIEFERNSTRASSE 38</u>	CITY <u>D-59379 SELM</u>	STATE & ZIP CODE/COUNTRY <u>GERMANY</u>
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.			
SIGNATURE OF INVENTOR 201 	SIGNATURE OF INVENTOR 202 	SIGNATURE OF INVENTOR 203 	
DATE <u>25. 02. 2002</u>	DATE <u>21. Jan. 2002</u>	DATE <u>31. Jan. 2002</u>	